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## REMARKS

Claims 1-36 are pending in the present application. Claims 11-15 and 28-35 have been withdrawn from consideration, Claims 7 and 36 have been canceled, Claims 1, 8-10, 17, 21, 25, and 27 have been amended, and Claim 37 has been added, leaving Claims1-6, 8-10, 16-27, and 37 for consideration upon entry of the present Amendment. Amendments to the Specification and the Claims are explained in detail below. No new matter has been introduced by these amendments. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

The first and second paragraphs on page 3 have been amended to delete the word "optional" in association with the toughening agent.

The first paragraph on page 13 has been amended to include references to polyimides, phenolic, benzoxazine, and polyurethanes resins. Support for this amendment may be found, at least, in the first full paragraph on page 8.

The fourth full paragraph on page 14 has been amended to positively recite the presence of the toughening agent.

The first full paragraph on page 17 has been amended to close the parentheses in "tris(2,4,6-tribromophenoxy-1,3,5-triazine)."

The paragraph bridging pages 21 and 22 has been amended to correct subject-verb agreement.

Claims 1 and 27 have been amended to recite a Markush group of thermosetting agents. Support for these amendments may be found in Claim 7 as filed. Claims 1 and 27 have been further amended to recite a Markush group of toughening agents. Support for these amendments may be found in the paragraph bridging pages 14 and 15 of the application as filed.

Claims 8-10 have been amended to depend from Claim 1.

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Claim 17 has been amended to recite a Markush group of brominated flame retardants. Support for this amendment may be found in the first paragraph on page 17 of the application as filed.

Claim 21 has been amended to depend from Claim 1 and to correct the misspelling of "copolymer."

Claim 25 has been amended to insert - - the - - before "toughening agent."

Election/Restriction

The office action states that the species election was made without traverse. (10/24/02 Office Action, page 2, paragraph no. 2.) Applicants respectfully note that their 15 July 2002 species election was made with traverse.

Claim Objections

Claim 21 was objected to as reciting "styrene-butadiene-styrene block co-copolymer." It has been amended to recite - - styrene-butadiene-styrene block copolymer - -, as suggested by the Examiner. (10/24/02 Office Action, page 2, paragraph number 3.) Applicants respectfully request that the objection be withdrawn.

Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 1-10, 16-27, and 36 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner has stated that

> The claims recite various components of the adhesive composition in particular weight percentages however several of the components read on one another, for example, the poly(arylene) ether resin may also [be] a thermosetting resin or a toughening agent, and the epoxy thermosetting resin may read on a toughening agent or cure agent or a flame retardant in the base of the brominated epoxy.

(10/24/02 Office Action, page 2, paragraph no. 5.) Claims 1 and 27 have been amended to

recite Markush groups for the thermosetting resin and toughening agent components. These amendments prevent the poly(arylene ether) resin, the thermosetting resin, and the toughening agent from reading on one another. Claim 17 has been amended to recite a Markush group of brominated flame retardants. This amendment prevents the brominated flame retardant, the poly(arylene ether) resin, and the epoxy thermosetting resin from reading on one another. Applicants believe that these amendments, along with the cancellation of Claims 7 and 36, fully address the Examiner's concern. Accordingly, Applicants respectfully request the reconsideration and withdrawal of the rejection of Claims 1-6, 8-10, and 16-27 under 35 U.S.C. § 112, second paragraph.

Claim 21 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner has pointed out that "Claim 21 recites the limitation 'adhesive of Claim 19, wherein the toughening agent is styrene-butadiene-styrene block co-copolymer' however Claim 19 recites that the toughening agent is polyvinyl butyral." (10/24/02 Office Action, page 3, paragraph no.6.) Claim 21 has been amended to depend from Claim 1. Applicants accordingly request that the rejection of Claim 21 under 35 U.S.C. § 112, second paragraph be withdrawn.

Claim Rejections Under 35 U.S.C. § 102(b)

Claims 1-10, 16-18, 22, 24-27, and 36 stand rejected under 35 U.S.C. § 102(b), as allegedly anticipated by European Patent Application No. 0 921 158 A2 to Yeager et al. (EP '158). Applicants respectfully traverse this rejection.

EP '158 generally describes poly(phenylene ether) (PPE) thermoset compositions comprising PPE, an allylic compound, at least one of a brominated epoxy compound and a mixture of a brominated and non-brominated epoxy compound, and at least one of a cure catalyst or a curing agent (abstract). Although this reference describes the use of an "additional thermoset or thermoplastic resin additive . . . for the purpose of improving properties such as toughness, impact strength or thermal stability" (page 9, lines 37-38), no specific toughening agents are taught.

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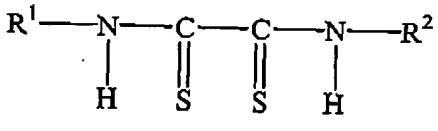
To anticipate a claim, a reference must disclose each and every element of the claim. *Lewmar Marine v. Varient Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987). Independent Claims 1 and 27 have been amended to recite a Markush group of toughening agents. None of the recited toughening agents is taught in EP '158. EP '158 therefore fails to anticipate Claim 1 or Claim 27 of the present application. Given that Claims 2-6, 8-10, 16-18, 22, and 24-27 each depend ultimately from Claim 1, and given that Claims 7 and 36 have been cancelled, Applicants respectfully request the reconsideration and withdrawal of the rejection of Claims 1-6, 8-10, 16-18, 22, and 24-27 under 35 U.S.C. §102(b).

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 19-21 and 23 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over EP '158 in view of U.S. Patent Nos. 4,496,695 to Sugio et al. (Sugio) or 5,712,039 to Marhevka et al. (Marhevka). Applicants respectfully traverse this rejection.

Sugio generally describes curable resin composition comprising: (a) a polyphenylene ether resin, (b) a maleimide component and/or a cyanate ester component, and (c) an epoxy compound (abstract).

Marhevka generally describes generally describes a curable, structural epoxy adhesive composition comprising: (a) an epoxy resin; (b) a curing agent for the epoxy resin; and (c) a compound of the formula I:



(I)

in which $R^1$ and $R^2$, which may be the same or different, are selected from an alkyl group, a hydroxyalkyl group, a cycloalkyl group, an aryl group, an arylalkyl group, or a heterocyclic group in which the one to three non-carbon atoms in the ring are independently selected from S, N, and O (abstract).

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a prima facie case of obviousness. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed.

Cir. 1988). Establishing a prima facie case of obviousness requires that all elements of the invention be disclosed in the prior art. *In re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A 1970). Applicants respectfully assert that independent Claim 1, from which rejected Claims 19-21 and 23 ultimately depend, is not obvious over the cited references because none of the recited references teaches any of the toughening agents recited in Claim 1. The Examiner has stated that

> polyvinyl butyral and styrene butadiene styrene are obvious species of toughening agents utilized which are suitable in the art for providing toughening properties to similar curable compositions . . . as taught by Marhevka et al or Sugio el al, wherein one having ordinary skill in the art would have been motivated to include these conventional additives in amount necessary to provide the desired toughening or plasticizing effect for a particular end use of the curable composition taught by EP '158.

(10/24/02 Office Action, page 5, paragraph 10.) Although Sugio lists "vinyl butyral resin" among several optional resins described as improving the chemical or physical properties of the coating (column 11, lines 10-22), neither Sugio nor Marhevka teaches the use of a styrene-butadiene-styrene block copolymer. More importantly, EP '158, Sugio and Marhevka collectively fail to teach any of the toughening agents recited in Claim 1.

Because the cited references fail to teach all elements of Claim 1, a prima facie case of obviousness has not been established. Given that Claims 19-21 and 23 each further limit Claim 1, they are patentable over the cited references.

Applicants further note that Claim 23 is further patentable over the cited references, because they fail to teach the specific phosphate plasticizers recited in the claim.

Applicants accordingly respectfully request the reconsideration and withdrawal of the rejection of Claim 19-21 and 23 under 35 U.S.C. §103(a) over EP '158 in view of Sugio or Marhevka.

New Claim

Claim 37 has been added to further claim the invention. Support for Claim 37 may be

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found on page 14, line 28 of the application as filed.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance is requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 07-0862 maintained by Assignee.

Respectfully submitted,

CANTOR COLBURN LLP
Applicants' Attorneys

By: J. Michael Buchanan
J. Michael Buchanan
Registration No. 44,571

Date: December 30, 2002
Customer No.: 23413
Telephone: (860) 286-2929

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## VERSION WITH MARKINGS TO SHOW CHANGES MADE

A marked-up version of the first paragraph on page 3 follows:

In the most generic form, the invention may be described as a curable, thermosetting adhesive composition for use with thermoplastic adherends comprising a poly(arylene ether) resin having a number average molecular weight in the range from about 8,000 to about 13,000, a thermosetting resin, [an optional] a toughening agent, a cure agent, and an optional plasticizer. In use, the composition may be blended, applied to the substrate to be adhered, partially cured or dried, and then fully cured joining the substrate to another adherend.

A marked-up version of the second paragraph on page 3 follows:

A curable, thermosetting adhesive composition comprises a poly(arylene ether) resin having a number average molecular weight in the range from about 8,000 to about 13,000, a thermosetting resin, [an optional] a toughening agent to compatibilize the poly(arylene ether) resin and the thermosetting resin, a cure agent, and an optional plasticizer.

A marked-up version of the paragraph bridging pages 3 and 4 follows:

This invention is directed to an adhesive resin composition having better processability, exhibiting reduced B-staged (partially cured) friability, and minimal flow during lamination. Specifically, the composition, comprising a poly(arylene ether), a toughening agent, and a thermosetting resin, is applied to a thermoplastic substrate that may have an electrically conductive metal, such as copper, on one side. Thermosetting resins are polymers that form a three-dimensional cross-linked network of polymer chains that cannot be softened or reheated for additional use. Before they are cross-linked, thermosetting resins are fluid and must contain enough reactive functionality to form a three-dimensional network during curing. General classes of thermosetting resins include, for example, epoxy, phenolic, alkyds, acrylate, polyester, polyimide, polyurethane, bis-maleimides, cyanate esters, vinyl, benzocyclobutene resins, and benzoxazines. These compositions may further contain various catalysts, flame retardants, and other constituents, if so desired. The thermosetting

components, such as those described above, may be used either alone or in combination with one another or with another thermoplastic resin. When used to coat suitable thermoplastic reinforcing material substrates such as thermoplastic polyimide, polyetherimides, polyesteretherimides, blends of poly(arylene ether) and polyimide, and blends of poly(arylene ether) and polyester, they furnish compatible substrates, particularly applicable for preparing laminated articles suitable for such applications as printed circuit boards, rigid flex circuit boards or any other articles where good dielectric properties are desired. The compositions, before crosslinking, are soluble in organic solvents, e.g., toluene, at elevated temperature and, while a gelling composition at room temperature, become liquid with shear, which facilitates coating of a substrate at room temperature. The cured adhesive layer materials prepared from the compositions are highly solder resistant, solvent resistant, moisture resistant, and flame retardant. The cured materials also have excellent dielectric properties and dimensional stability at high temperatures.

A marked-up version of the first paragraph on page 13 follows:

Other useful thermosetting components comprise vinylic compounds, including triallylisocyanurate, triallylcyanurate, diallyl phthalate, diallyl isophthalate, diallyl maleate, diallyl fumarate, diethylene glycol diallylcarbonate, triallyl phosphate, ethylene glycol diallyl ether, allyl ethers of trimethylolopropane, partial allyl ethers of pentaerythritol, diallyl sebacate, allylated novolacs, allylated resol resins, polyimides, phenolic resins, benzoxazines, polyurethanes, and/or cyanate esters. These various thermosetting resins can be used either individually or in combination with one another.

A marked-up version of the fourth full paragraph on page 14 follows:

A toughening agent [may be] is included in the composition to enhance blending and crosslinking of the poly(arylene ether) and the thermosetting resin portion of the adhesive composition. The presence of toughening agents generally reduces friability of the partially cured composition. In the final blend, the functionalized poly(arylene ether)s are commonly referred to as "toughened poly(arylene ethers)s" because of the resultant improved compatibility between the poly(arylene ether)s and the other components. Accordingly, other

agents that affect the compatibility of the poly(arylene ether) with the various components of the blend (e.g., the thermosetting resin) are toughening agents. Compatibility is meant to include the stabilization of gross phase separation between the components of the blend. Indicators of improved compatibilization include, for example, increased ductility and improved phase morphology stabilization. Improved compatibility of the blend components contributes to the desirable physical properties of the adhesive.

A marked-up version of the first full paragraph on page 17 follows:

Flame retardant additives include both reactive and non-reactive flame retardant additives such as tetrabromobisphenol A derivatives, including the bis(2-hydroxyethyl)ether of tetrabromobisphenol A, the bis(3-acryloyloxy-2-hydroxypropyl) ether of tetrabromobisphenol A, the bis(3-methacryloyloxy-2-hydroxypropyl) ether of tetrabromobisphenol A, the bis(3-hydroxypropyl) ether of tetrabromobisphenol A, the bis(2,3-dibromopropyl) ether of tetrabromobisphenol A, the diallyl ether of tetrabromobisphenol A, and the bis(vinylbenzyl) ether of tetrabromobisphenol A; pentabromobenzyl acrylate; dibromostyrenes; tribromostyrenes; tetrabromocyclooctanes; dibromoethyldibromocyclohexanes such as 1,2-dibromo-4-(1,2-dibromoethyl)-cyclohexane; ethylene-bis-tetrabromophthalimide; hexabromocyclododecanes; tetrabromophthalic anhydrides; brominated diphenylethers such as decabromodiphenyl ether; poly(2,6-dibromophenylene ether); and tris(2,4,6-tribromophenoxy-1,3,5-triazine); as well as phosphorus-containing additives, for example, the phosphorus-containing additives described above and those described in R. Gachter and H. Muller (eds.), P. P. Klemchuck (assoc. ed.), "Plastic Additives Handbook, 4th Edition", Hansen Publishers, (1993). Such additives are typically used in concentrations of about 12 to about 20 weight percent of the brominated additive, or about 15 to about 25 weight percent of the phosphorous-containing additive. Flame retardance may also be imparted to the compositions by the inclusion of brominated thermosetting resins, for example a brominated poly(epoxide), or a poly(arylene ether) having a phosphorous-containing moiety in its backbone.

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A marked-up version of the paragraph bridging pages 21 and 22 follows:

Poly(arylene ether)-epoxide adhesive compositions were prepared having the compositions as outlined in the Table 2. First, the poly(arylene ether) was dissolved in toluene and tetrabromobisphenol-A diglycidyl ether to produce a solution containing approximately 40% solids. The solution was heated to 90°C to 100°C, followed by addition of bisphenol A and benzoyl peroxide (or, with benzoyl peroxide alone) and maintained at 90°C to 100°C for approximately 90 minutes. The solution was allowed to cool and the styrene-butadiene-styrene (SBS) block co-polymer or polyvinyl butyral compatibilizer [were] was added. The other epoxy resins (bisphenol-A diglycidyl ether/tetrabromo bisphenol-A condensation product and epoxidized novolac) were added and the amount of toluene adjusted to generate a resin solution having 50 weight percent solids. A cure agent package consisting of zinc octoate, 2-methyl-4-ethylimidazole, and diaminodiethylbenzene was then added to complete the formulation.

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Marked-up versions of Claims 1, 8-10, 17, 21, 25, and 27 follow:

1. (Amended/Marked-up) An adhesive formed from a composition comprising, based on 100 weight percent of the resin portion of the composition:

about 5 to about 50 weight percent of a poly(arylene ether) resin having a number average molecular weight of about 8,000 to about 13,000;

about 50 to about 90 weight percent of a thermosetting resin selected from the group consisting of cyanate esters, polyesters, epoxy, benzoxazines, benzocyclobutene resins, and mixtures thereof;

about 0.5 to about 15 weight percent of a toughening agent selected from the group consisting of poly(vinyl butyral-*co*-vinyl acetate) resins, partially hydrolyzed poly(vinyl butyral-*co*-vinyl acetate) resins, styrene-butadiene-styrene block copolymers, styrene-ethylene-styrene block copolymers, and styrene-ethylene-butylene-styrene block copolymers; and

about 0.1 to about 7 weight percent of a cure agent.

8. (Amended/Marked-up) The adhesive of Claim [7] 1, wherein the thermosetting resin is an epoxy resin comprising the condensation product of a bisphenol polyglycidyl ether and a bromine-substituted bisphenol.

9. (Amended/Marked-up) The adhesive of Claim [7] 1, wherein the thermosetting resin is an epoxy resin that is the reaction product of tetrabromobisphenol A and the diglycidyl ether of bisphenol A or bisphenol F, the reaction product having an average of at most one aliphatic hydroxy group per molecule, and the reaction product comprising about 10 to about 30 weight percent bromine as aryl substituents.

10. (Amended/Marked-up) The adhesive of Claim [7] 1, wherein the thermosetting resin comprises at least one halogen-free epoxidized novolac [is present].

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17. (Amended/Marked-up) The adhesive of Claim 16, further comprising a brominated flame retardant selected from the group consisting of bis(2-hydroxyethyl)ether of tetrabromobisphenol A, the bis(3-acryloyloxy-2-hydroxypropyl) ether of tetrabromobisphenol A, the bis(3-methacryloyloxy-2-hydroxypropyl) ether of tetrabromobisphenol A, the bis(3-hydroxypropyl) ether of tetrabromobisphenol A, the bis(2,3-dibromopropyl) ether of tetrabromobisphenol A, the diallyl ether of tetrabromobisphenol A, and the bis(vinylbenzyl) ether of tetrabromobisphenol A, pentabromobenzyl acrylate, dibromostyrenes, tribromostyrenes, tetrabromocyclooctanes, dibromoethyldibromocyclohexanes, ethylene-bis-tetrabromophthalimide, hexabromocyclododecanes, tetrabromophthalic anhydrides, brominated diphenylethers, and tris(2,4,6-tribromophenoxy-1,3,5-triazine).

21. (Amended/Marked-up) The adhesive of Claim [19] 1, wherein the toughening agent is styene-butadiene-styrene block [co-]copolymer.

25. (Amended/Marked-up) The adhesive of Claim 1, comprising:

about 20 to about 40 weight percent of the poly(arylene ether) resin;

about 52 to about 80 weight percent of the thermosetting resin;

about 3 to about 10 weight percent of the toughening agent; and

about 0.1 to about 7 weight percent of the cure agent.

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27. (Amended/Marked-up) An adhesive formed from a composition comprising, based on 100 weight percent of the resin portion of the composition:

about 5 to about 50 weight percent of a poly(arylene ether) resin, wherein the poly(arylene ether) has a number average molecular weight of about 8,000 to about 13,000, and wherein the poly(arylene ether) is the reaction product of a higher molecular weight poly(arylene ether) with a peroxide and, optionally, a phenolic compound;

about 50 to about 90 weight percent of a thermosetting resin resin selected from the group consisting of cyanate esters, polyesters, epoxy, benzoxazines, benzocyclobutene resins, and mixtures thereof;

about 0.5 to about 15 weight percent of a toughening agent selected from the group consisting of poly(vinyl butyral-*co*-vinyl acetate) resins, partially hydrolyzed poly(vinyl butyral-*co*-vinyl acetate) resins, styrene-butadiene-styrene block copolymers, styrene-ethylene-styrene block copolymers, and styrene-ethylene-butylene-styrene block copolymers; and

about 0.1 to about 7 weight percent of a cure agent.